INSTRUCTION MANUAL

DUAL TRACKING

DC POWER SUPPLY

S/N 26122491

MODEL PDM 35-3

Kikusui
INTERNATIONAL CORP.

# INSTRUCTION MANUAL

## DUAL TRACKING

## DC POWER SUPPLY

S/N 26122491

## MODEL PDM 35-3

KIKUSUI ELECTRONICS CORPORATION

On Power Supply Source, it is requested to replace the related places in the instruction manual with the following items.

( Please apply the item of √ mark )

☑ Power Supply Voltage: to ....120. ..VAC

☐ Line Fuse: to .....A

☑ Power Cable: to 3-core cable ( See Fig. 1 for the colors )

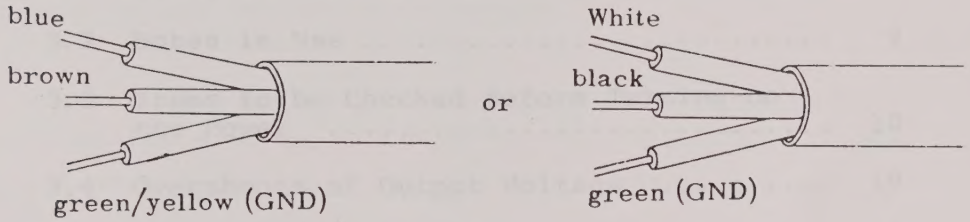


Fig. 1

Please be advised beforehand that the above matter may cause some alteration against explanation or circuit diagram in the instruction manual.

* AC Plug : In case of the Line Voltage 125V AC or more, AC Plug is in principle taken off and delivered, in view of the safety.

( AC Plug on 3-core cable is taken off in regardless of input voltages. )

Before using the instrument, it is requested to fix a suitable plug for the voltage used.

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# 1. GENERAL

Kikusui Model PDM 35-3 Tracking-type Dual Tracking DC Power Supply employs general-purpose monolithic IC's and silicon semiconductors and provides excellent electrical performances and operation reliability.
The rectifier circuit is a preregulator type which employs SCR's. The power supply is designed compact by supressing the loss of the series transistors.

The power supply provides a positive and a negative powers at the same time. That is, the power supply can be used as a dual power supply of 0 ~ +35 V and 0 ~ -35 V or as a single power supply of 0 ~ 70 V.

The output current rating is 3.0 A for both positive and negative powers. Each power supply circuit has a constant current transfer type of current limiting circuit in order to protect against overload and output shorting. The overload state is indicated by an LED light. When either one of the two output has become overloaded, the other one tracks the output voltage of the overload domain.

The power supply employs such a tracking system that the negative output voltage follows the positive output voltage. The setting of the negative output voltage is adjustable continuously-variably for a range of ±20% of the setting of the positive output voltage. (Note: When in this mode of operation, the maximum negative output voltage is limited at -37 V.)

The output voltage is finely adjustable with the 10-turn helical potentiometer. The output can be easily ON-OFF controlled with the OUTPUT switch on the equipment front panel. Other than in the single unit operation, the equipment can be used in one-control parallel operation and remote-control operation.

The width of the equipment front panel is a half of that of the standard 19-inch (500-mm) rack. Two equipment units can be installed in parallel on the rack. The outputs are available also at the rear terminal block.

## 2. SPECIFICATIONS

| | |
|---|---|
| Input power: | 100 V, 50/60 Hz single-phase AC;<br>at full load: ±35 V, ±3A;<br>approx. 590 VA |
| Ambient temperature: | 0°C ~ 40°C |
| Dimensions:<br>(Maximum dimensions): | 210 W × 140 H × 360 D mm<br>215 W × 165 H × 415 D mm |
| Weight: | Approx. 14 kg |
| Accessories: | Shorting bar ..... 1<br>Instruction manual .... 1<br>Fuses, 8 A, (replacement spare) ..... 2 |
| Front terminals: | Binding posts, 19 mm spacing, inverted T-shape layout.<br>Color code: Red (+), white (-), black (COM), black (GND) |
| Voltage to ground: | ±150 V maximum |
| Output voltage: | (1) 0 ~ ±35 V (complimentary outputs)<br>(2) 0 ~ 70 V (series output) |
| Output current: | 3.0 A maximum |

Ripple noize: (1) 0.5 mV rms (complimentary outputs)
(2) 1 mV rms (series output)
(5 Hz ~ 1 MHz)

Output regulation: Line voltage regulation (against ±10% change of AC line power)

(1) 0.005% + 1 mV (complimentary outputs)
(2) 0.005% + 2 mV (series output)

Load regulation (against 0 ~ 100% change of load)

(1) 0.005% + 1 mV (complimentary outputs)
(2) 0.005% + 2 mV (series output)

Transiential response: (Against 10% ~ 100% change of load)

50 μsec (typical)

Spec: Period for recovering to within 0.1% of output voltage

Temperature coefficient: 100 PPM (typical)

Dual tracking: 0 ~ ±35 V
with 10-turn helical potentiometer

| | |
|---|---|
| Tracking adjustment: | Negative output voltage continuously-variably adjustable for ±20% with respect to positive output voltage<br><br>Note: Negative output voltage is limited at -37 V. |
| Overload protection circuit: | Automatic constant-current transfer type (set current 3.2 A)<br><br>Overload state is indicated by LED (red). When one of the two output is transferred into the constant-current domain, the other output follows the voltage of the output which is transferred. |
| Temperature detection circuit: | Cuts off the output when heat sink temperature has exceeded 110°C. |
| Indicating meters: | Voltmeter: 35 V DC, JIS class 2.5 (Positive/negative selection by switch)<br><br>Ammeter: 3 A DC, JIS class 2.5 (Positive/negative selection by switch) |
| Insulation resistance: | Between input and GND: 500 V DC, 30 MΩ<br><br>Between output and GND: 500 V DC, 20 MΩ |

# 3. EXPLANATION OF PANELS AND OTHER ITEMS

## 3.1 Explanation of Front and Rear Panels

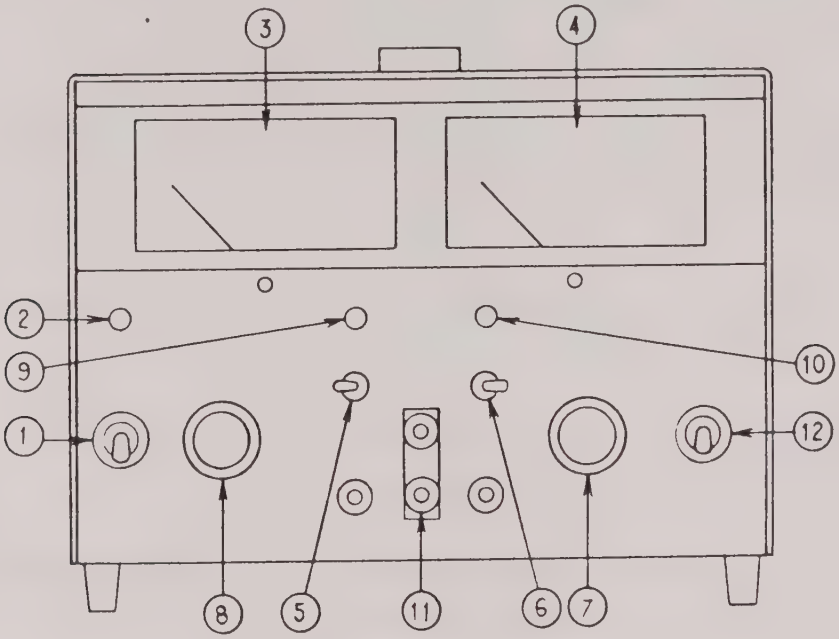


Figure 3-1 Front panel

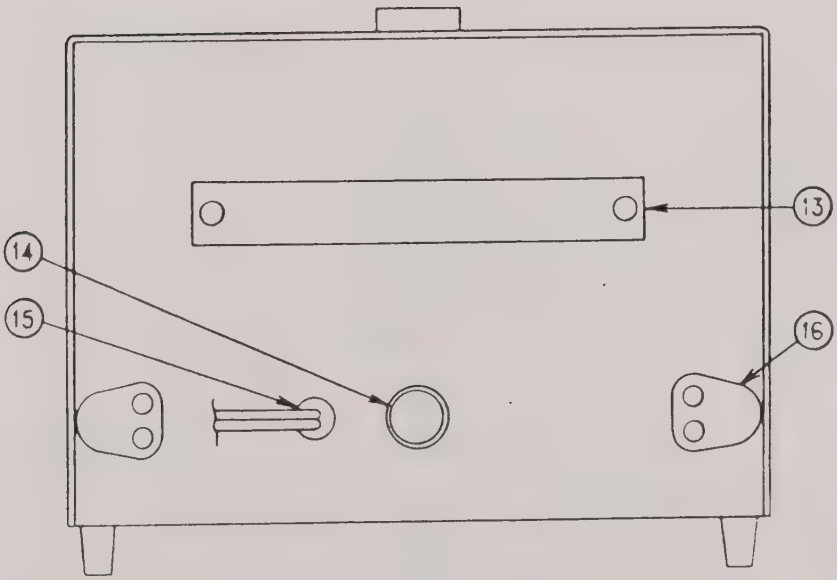


Figure 3-2 Rear panel

(1) INPUT POWER switch: For ON-OFF control of input power. Top position is for ON, and LED (green) light turns-on.

(2) POWER LED: Turns-on to indicate that the input power is being applied. (green)

(3) AMMETER: Output ammeter, 3.0 A full scale. Accuracy: JIS Class 2.5

(4) VOLTMETER: Output voltmeter, 35 V full scale Accuracy: JIS Class 2.5

(5) AMMETER switch: Selects ammeter polarity between positive and negative.

(6) VOLTMETER switch: Selects voltmeter polarity between positive and negative.

(7) DUAL TRACKING potentiometer:

Adjusts the positive and negative output voltages at the same time. The output increases as this potentiometer (10-turn helical potentiometer) is turned clock-wise.

(8) NEGATIVE OUTPUT potentiometer:

Adjusts the negative output voltage within a range of ±20% of set value of positive output voltage.

Note: When the positive output voltage is 31 V or over and this potentiometer is set at +20%, the negative output voltage is limited at -37 V.

(9) OVERLOAD LED: Turns-on when the negative output has become an overload state when transferred to the constant-current domain). Approx. 3.2 A (red LED)

(10) OVERLOAD LED Turns-on when the positive output voltage has become an overload state (when transferred to the constant-current domain). Approx. 3.2 A (red LED)

(11) OUTPUT terminals: Consist of NEGATIVE terminal (white), COM terminal (black), POSITIVE terminal (red), and GND terminal. Provide ±35 V outputs (complimentary) or 70 V output (series).

(12) OUTPUT switch: For ON-OFF control of output power.

Note: If this switch is ON-OFF operated with the output being shorted, the switch may be fused and it may become impossible to turn-off the power. Do not operate this switch under such state.

(13) Rear terminal block: Has OUTPUT terminals (negative, GND, COM, POSITIVE terminals), ONE-CONTROL PARALLEL-OPERATION terminals, and REMOTE CONTROL terminal.

(14) Input fuse holder: Has 8-ampere fuse.

(15) AC power cord

(16) Power cord takeup

3.2 Notes in Use

(1) Input power

| | |
|---|---|
| Input voltage: | 100/110/117 V ± 10%, AC |
| Frequency: | 48 ~ 62 Hz |
| Standard: | 100 V ± 10%, AC |
| Apparent power: | 590 VA |

(2) Output: Available at binding post terminals on front panel and at rear terminal block. Make sure that the jumper bar of rear terminal block is securely connected.

(3) Ambient temperature: 0°C ~ 40°C

(4) Place of use: Do not use the equipment under any of the following conditions:

- o High humidity, dusty
- o Not well ventilated
- o Near a souce of heat

## 3.3 Items to be Checked Before Turning-on the Power

(1) Check that the AC line voltage is within the specified tolerance.

(2) Check that the fuse is of the correct rating (8 amperes).

## 3.4 Overshoots of Output Voltage

When the input power switch is turned on or off, no overshoot voltages higher than the set voltage are produced.

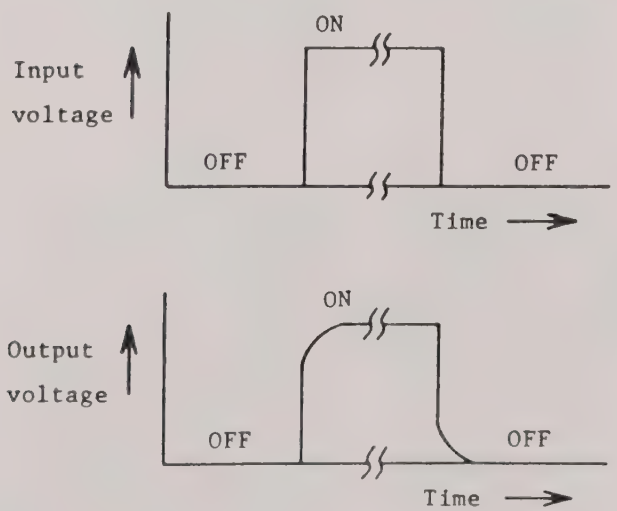


Figure 3-3

## 3.5 Transiential Response

This equipment responds sufficiently rapidly to transiential changes. It can handle such load as digital circuit the loading effect of which changes rapidly and transientially. This rapid response signifies also that the equipment can handle a wide range of frequencies and also that the circuit is a readily oscillatable state or not.

The transiential response speed (see ranges or less) depends on the characteristics of the capacitor connected in parallel to the output terminals of the voltage regulating circuit and on the wiring length.

The length meant in the above is that of the wires only to the output terminals. When the wires which connect this equipment to the load is long, the inductance of these wires becomes not negligible. In such a case, connect capacitors between the output wires (in a position as close to the load as possible) in order to make up a filter circuit as a typical example shown in Figure 3-4.

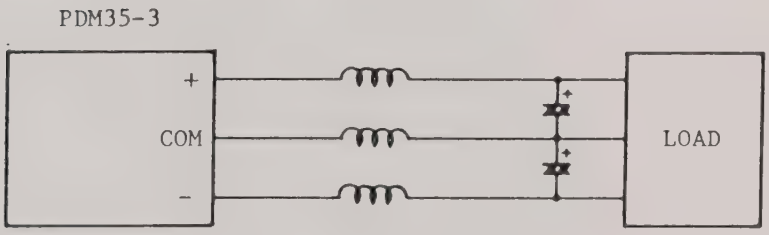


Figure 3-4

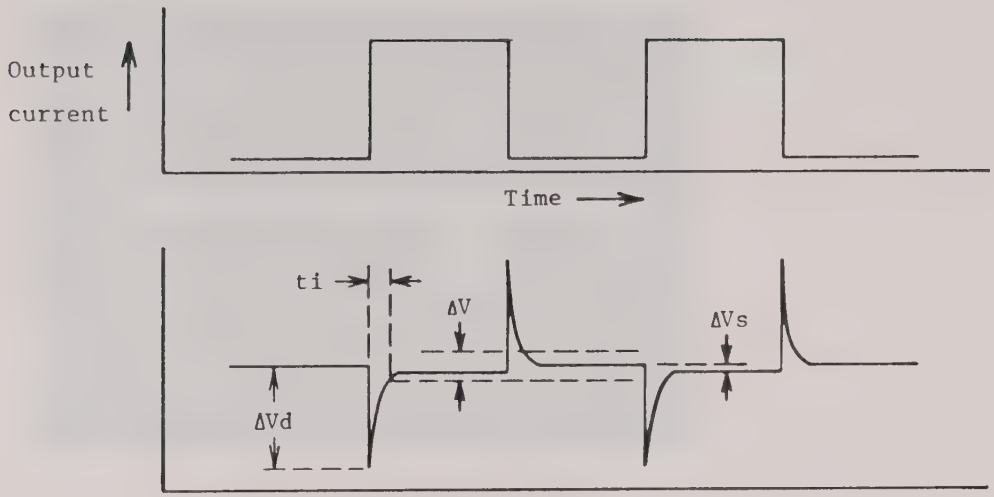


Figure 3-5

ΔV : Output variation range (specification value)

ΔVs: Actual static variation (load variation)

ΔVd: Dynamic variation

ti: Transiential response time

ΔV: 0.1% of output voltage

Typical value (transiential response time)
..... 50 μsec

Output current variation range: ..... 10%~100%



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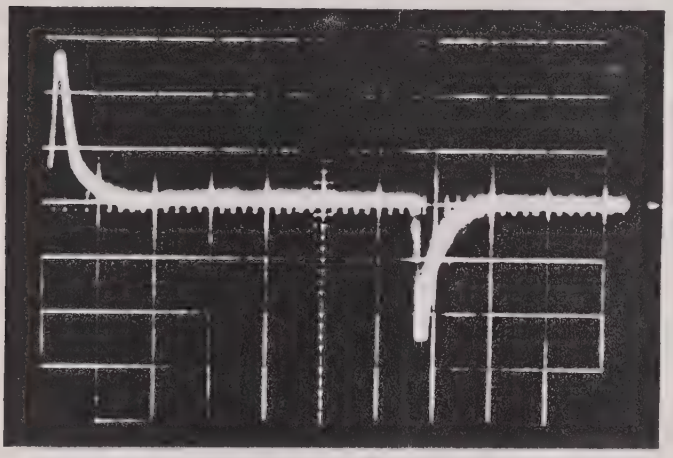
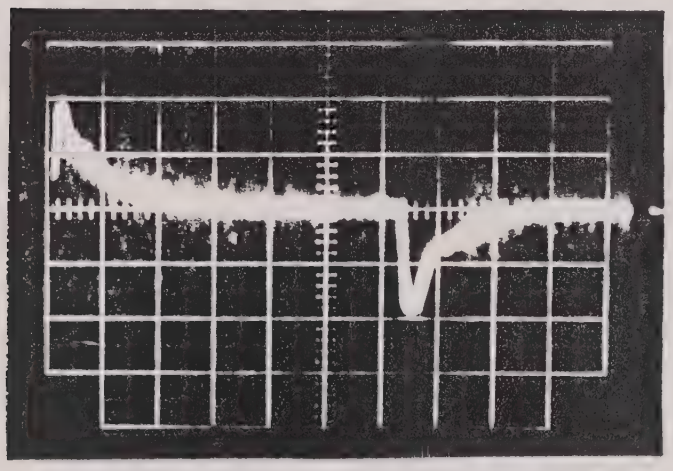
Transiential response of +35 V circuit



VERT: 50 mV/DIV
HOR: 50 µsec/DIV

Figure 3-6

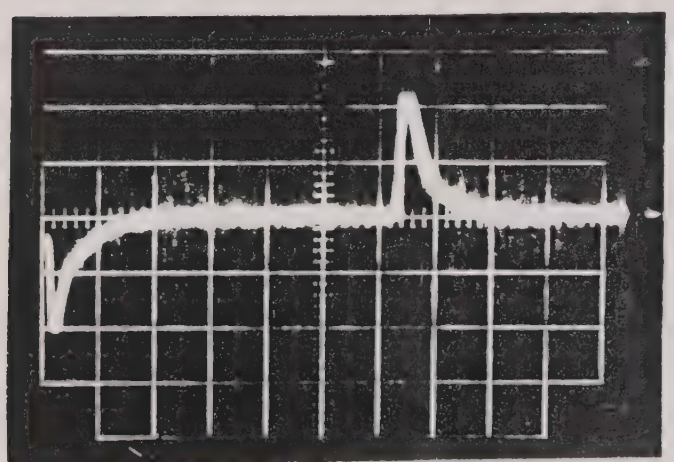
Transiential response of -35 V circuit



VERT: 50 mV/DIV
HOR 50 µsec/DIV

Figure 3-7

Transiential response of 70 V circuit



VERT: 100 mV/DIV
HOR: 50 µsec/DIV

Figure 3-8

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## 3.6 Complimentary Output and Series Output

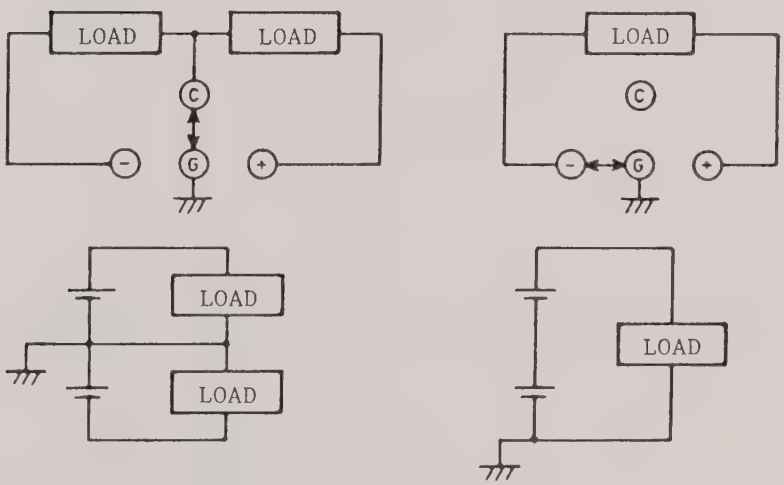
The two major methods in which the output of PDM 35-3 are available are as follows:

(1) Complimentary output:

The COM terminal is grounded and the positive and negative outputs of 0 ~ -35 V are used.

(2) Series output:

The positive or negative terminal is grounded and the 0 ~ +70 V or 0 ~ -70 V is used.




+: Positive output terminal
-: Negative output terminal
C: COM output
G: GND

a) Complimentary output b) Series output

Figure 3-9



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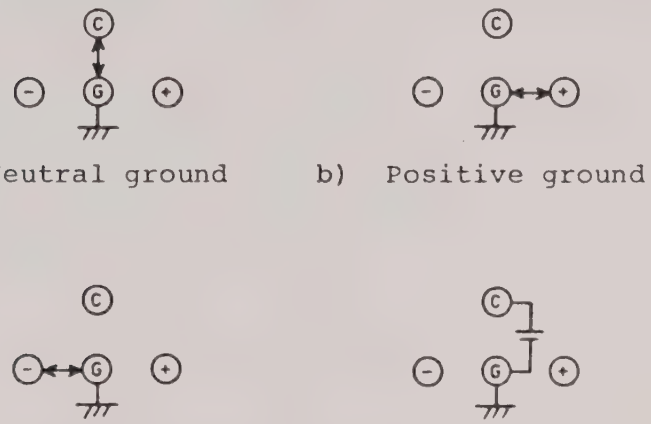
Normally, the COM, positive or negative output terminal is connected with the shorting bar to the GND terminal (which is electrically connected to the chassis and panel). It also is possible to apply a DC bias voltage up to ±150 V.




a) Neutral ground b) Positive ground

c) Negative ground d) With DC bias

Figure 3-10

## 3.7 Use of Negative Output ±20% Variable Knob

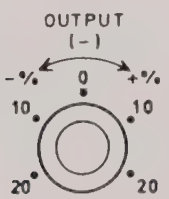



Figure 3-11

With this knob the negative voltage is adjustable for ±20% of the positive voltage. To set the positive and negative voltages at the same value, this variable



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knob should be set in the 0% position. When this is done, the output voltages (the same for positive and negative) are adjustable with the DUAL TRACKING knob.

If the positive voltage become higher than 31 V while the negative output variable knob is set at +20%, the negative output voltage is limited at 37 V.

Note: When the negative voltage is limited at 37 V, if the negative output variable knob can be turned further in the +% direction, the positive output voltage decreases. This is not an abnormal indication.

## 3.8 Use of VOLTAGE DUAL TRACKING Knob

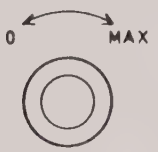



Figure 3-12

When in the complimentary mode, both positive and negative voltages are adjustable with the DUAL TRACKING knob at the same rate. The extremely counterclockwise position of the knob is for 0 volt. With this 10-turn helical potentiometer, the output voltages are finely and smoothly adjustable.

When in the series output mode, the output is adjustable from zero to the maximum voltage (70 V) with this potentiometer.

Note: When in the series output mode, set the negative output $\pm$20% variable knob at the 0% position or a lower position.

(Due to the action of the negative output limiting circuit, the specification values of ripples and regulations may not be satisfied.)

## 3.9 Complimentary Output

| Positive output | Negative output $\pm$20% variable knob |
|---|---|
| +35 V | 0%: -35 V |
| +35 V | +10%: Limited at -37 V |
| +35 V | -20%: -28 V |
| Reduced to lower than +35 V (set at +35 V) | +20% Limited at -37 V |

# 4. OPERATION METHOD

## 4.1 Single operation

Layout of the rear terminals and connections of the shorting bars are as shown in Figure 4-1.

As shown there, the output is available at the rear terminals also.

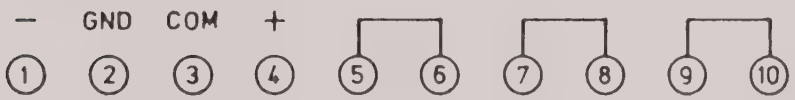



Figure 4-1

To operate the equipment as a single independent unit, proceed as follows:

(1) Connect the power cord and turn-on the power switch. The green LED will light and the equipment will start operating.

(2) Set the negative voltage $\pm$20% knob in the 0% position.

(3) Set the output at the required voltage with the DUAL TRACKING knob.

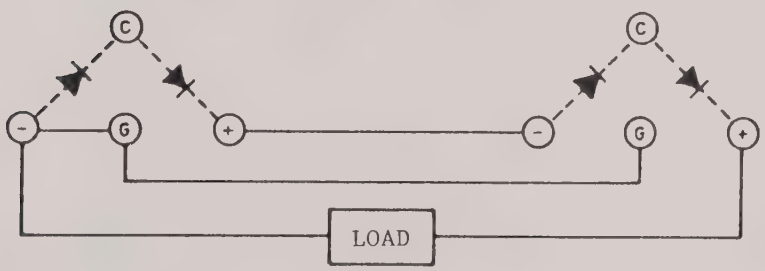
(4) Turn-off the output switch and connect the load to the output terminals.

(5) Turn-on the output switch. The power will be supplied to the load.

Note: The overcurrent setting is fixed at 3.2 A and not adjustable.

## 4.2 Series Operation

(1) By using two units in series, an output up to 140 V can be obtained. For output connections, refer to Figure 4-2. Do not connect the COM terminals.




(negative ground)

Figure 4-2

When overload is caused in the above series operation, the output of the unit the protecting circuit of which trips later is applied to the other unit the protecting circuit of which trips sooner, and the series transistors of the latter unit are overloaded and damaged. In order to prevent this, diodes are connected between output terminals.

(2) Biased complimentary outputs:

When this equipment is used in the complimentary mode, the outputs are ±35 V maximum. When voltages higher than ±35 V are required, a DC bias voltage should be connected in series to each output voltage as shown in Figure 4-3.

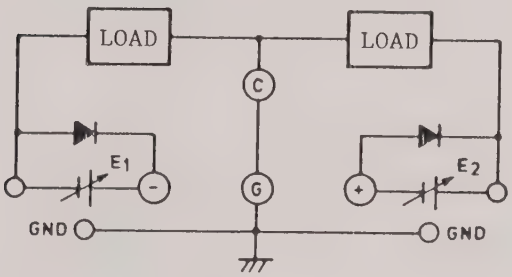



Figure 4-3

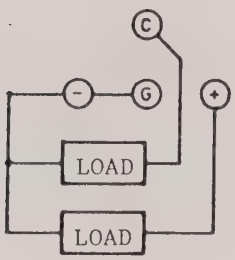
When bias voltages are connected as above, the available maximum voltages become $-(35 + E_1)$ V, $(35 + E_2)$ V.

In the above case, sources $E_1$ and $E_2$ must have a sufficient current rating for the load and must be provided with protecting diodes against overloading. (All of Kikusui Transistorized Regulated DC Power Supplies are incorporated with protection diodes.)

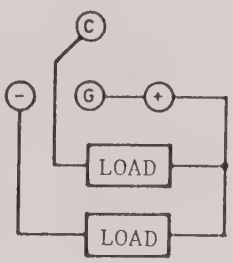
Note that the voltage against the ground must not exceed the specification value.

(3) Other uses

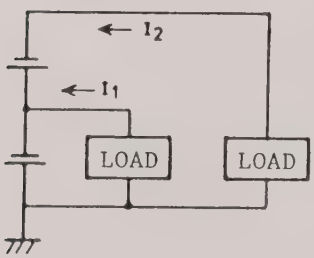
This equipment normally is used in the complimentary output mode or series output mode. However, if it is required to use both outputs in the positive or negative polarity, this can be done in the methods as shown in Figure 4-4 although the currents are not available up to the rated values in this case.

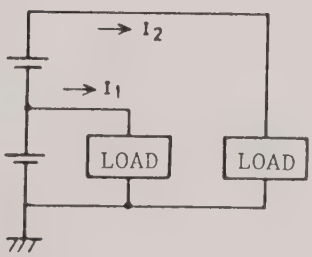



(a) Two positive outputs




(b) Two negative outputs




Note: Pay attention so that the sum of the two currents does not exceed 3.0 A.

Figure 4-4

## 4.3 Parallel Operation

When a current more than can be supplied by a single unit is required, two units can be operated in parallel simply by connecting their outputs in parallel.

(1) Set the output voltages of the parallel-operated units as close to the required voltage (load voltage) as possible. (The difference of set voltages is directly reflected on load variation.)

(2) Connect together the output terminals of the same polarity, and connect the load to the output terminals. Also make the ground polarities the same. (For series operation)

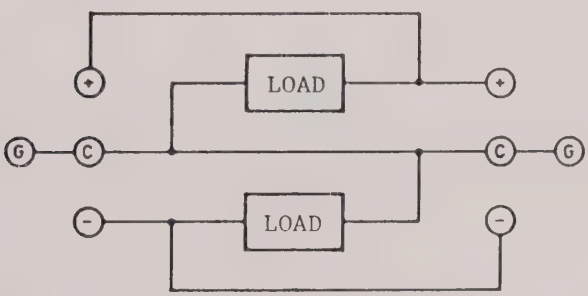



Figure 4-5 Connection for parallel operation (Complimentary outputs)

Voltage and current characteristics when in parallel operation:

The voltage and current characteristics when in the parallel operation is as shown in Figure 4-6. Unit A (the output voltage of which is higher than that of other unit B) operates until it becomes overloaded. When the current of unit A has entered the constant-current domain, its output voltage drops. When the voltage has fallen to the set voltage of unit B, the output terminal of unit B is driven into the normal state from the reverse-voltage state and unit B starts operating in the constant-voltage mode. Thus, the difference (ΔV) of the set voltages is directly reflected on load regulation. If ΔV is large, voltage regulation is poor and ripples and other characteristics are degraded.

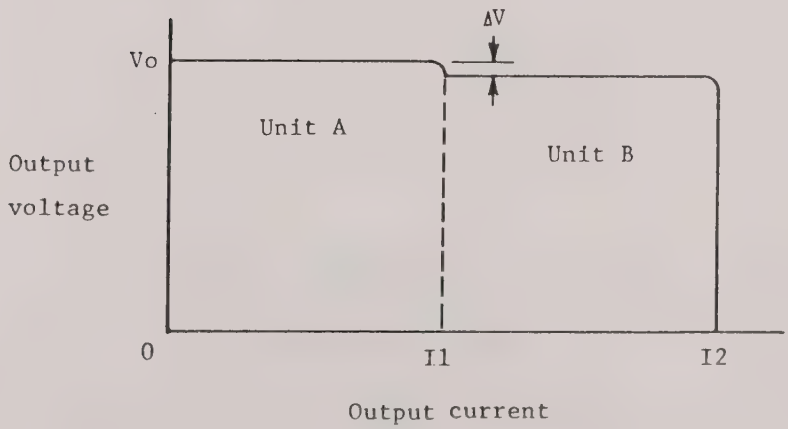



Figure 4-6 Voltage and current characteristics when in parallel operation

## 4.4 One-control Parallel Operation

The one-control parallel operation method is used when a current larger than available with a single unit is required and degradiation of characteristics is undesirable.

(1) Connect as shown in Figure 4-7 the rear terminals of the master unit (which controls the output voltage) and the slave unit (of which output voltage is controlled).

(2) Connect the load to the rear output terminals. To turn-on the system, turn-on the power switch (output switch) of the master unit first and that of the slave unit next; to turn-off the system, turn-off the power switch of the slave unit first and that of the master unit next.

Notes: (1) The load may be connected to the front terminals. In this case, however, load regulation is slightly degrated and the current balance between master and slave units becomes poor.

(2) Keep the DUAL TRACKING knob of the slave unit in the extremely clock-wise position.

(3) When in the one-control parallel operation, up to two slave units can be used.

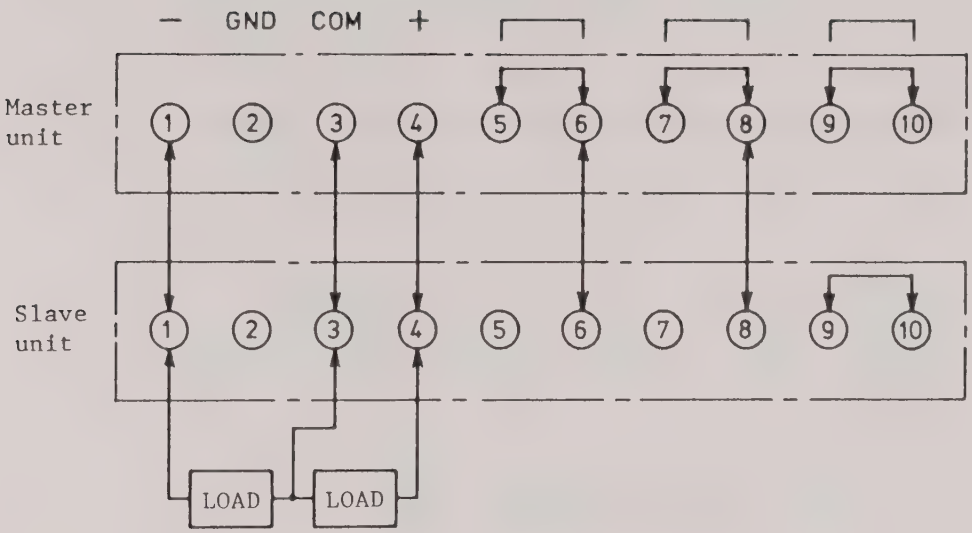



Figure 4-7 One-control parallel operation

## 4.5 Remote Control Operation

The remote control operation is for externally controlling the output voltage.

(1) Turn-off the power switch. (Be sure to turn-off the power switch when handling the rear terminal.)

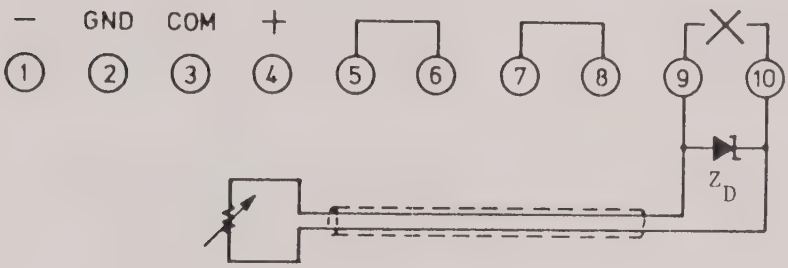
(2) Turn-off the output switch.

(3) Be sure to turn the DUAL TRACKING knob the front panel to the extremely counterclockwise position.

Note: Be sure to do the above. If not, an unnecessary large voltage is produced.

(4) Disconnect the jumper from between terminals (9) and (10).

(5) Connect a resistor between terminals (9) and (10).




(Connect the shield wire of the 2-core cable to the negative output terminal.)

Figure 4-8

The function of the remote control resistor is similar to that of the DUAL TRACKING resistor and the negative output voltage can be set with the negative output ±20% variable knob.

(Note: Negative output limiting voltage = -37 V)

When the positive and negative outputs at the same value are reauired to be controlled with an external resistor, the negative output ±20% variable knob must be set in the 0% position. In this case, the output voltage is as follows:

$\pm E_{OUT}$ (complimentary output) = 0.0035 R

$R(\Omega) \leqq 10\ k\Omega$

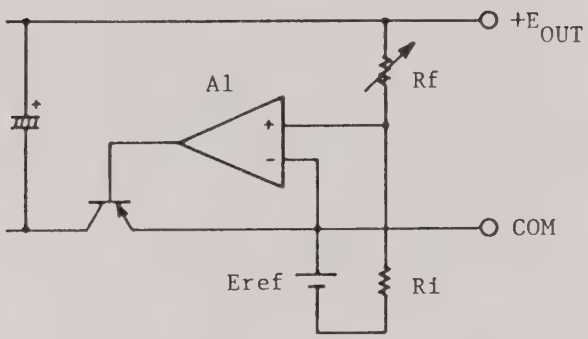
To protect the load, a zener diode ($Z_D$) may be connected between terminals (9) and (10) so that the output voltage does not become higher than the zener voltage.

* Application of remote control:

  By using a fixed resistor and a variable resistor, the output voltage is adjustable for several percent of the set voltage for the full span of the variable resistor. That is, as the resolution of the output voltage depends on fixed resistor R, any required resolution can be obtained. A programmed voltage output also can be obtained by changing the preset resistors with a switch (use a closed-circuit switch which provides constantly a closed circuit when switching).

## 5. OPERATING PRINCIPLE

### Basic Circuit




Eref:
Reference voltage

Ri: Input resistance

Rf: Feedback resistan

Figure 5-1

The positive output voltage ($E_{OUT}$) when in the complimentary operation is expressed as follows (denoting by A1 and ideal amplifier):

$$E_{OUT} = - \frac{Rf}{Ri} \times Eref \qquad (1)$$

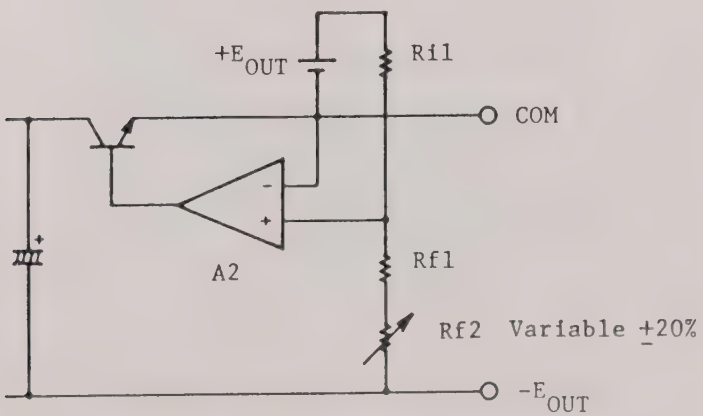



Figure 5-2

The negative output ($-E_{OUT}$) when in the compli-mentary operation is expressed as follows:

$$-E_{OUT} = -\frac{Rf1 + Rf2}{Ri1} \times (+E_{OUT}) \qquad (2)$$

Substituting equation (1) into equation (2), the folling equation can be written.

$$-E_{OUT} = -\frac{Rf1 + Rf2}{Ri1} \times (-\frac{Rf}{Ri} \times Eref) \qquad (3)$$

(A2 denotes an ideal amplifier.)

Equation (1), (2) and (3) indicate that the output voltage depends only on Eref, Ri and Rf.

As can be known from the above, to stabilize the positive and negative output voltages, Eref, Ri and Rf must be stabilized by protecting them against external changes in voltage and environment. Error amplifiers A1 and A2 also must be as close to ideal ones as possible. For the reference voltage source, 50 PPM zener diodes are used. For input resistor Ri and feedback resistor Rf, a metallic film resistor and wound-wire resistor of excellent temperature characteristics and less aging changes are used. General-purpose monolithic ICs are used for the error amplifiers.

# 6. MAINTENANCE AND ADJUSTMENTS

To operate the equipment always in the best conditions, provides maintenance and adjustment service at regular intervals.

## 6.1 Clean the Equipment

When the panel and cover have become dirty, clean them with a cloth moistened with alcohol or diluted neutral soap solution and, then, wipe with a clean, dry cloth. Do not use thinner or benzine. Remove dust collected in the ventilation holes of the casing and inside the equipment, use a compressed air or a vacuum cleaner.

## 6.2 Check of Power Cord

Check that the power cord and its plug are in a good state.

## Adjustments

## 6.3 Calibration of Voltmeter

Calibrate the voltmeter by connecting to the output terminals a voltmeter of an accuracy of 0.5% or better, setting the output voltage at 35.0 V (complimentary output) and adjusting potentiometer R144.

## 6.4 Calibration of Ammeter

Calibrate the ammeter by connecting to the output terminals an ammeter of an accuracy of 0.5% or better, setting the output current at 3.0 A (complimentary output), and adjusting potentiometer R140 for the positive output and potentiometer R142 for the negative output.

## 6.5 Adjustment of Maximum Positive Output Voltage

Connect a voltmeter of an accuracy of 0.5% or better between positive output terminal and COM terminal and so adjust potentiometer R202 that the output voltage when the DUAL TRACKING knob is turned to the extremely clockwise position becomes 36.0 V.

## 6.6 Adjustment of Maximum Negative Output Voltage

Set the positive output voltage at 31.0 V, turn the OUTPUT (-) knob to the extremely clockwise position (+20%), connect an ammeter of an accuracy of 0.5% or better between negative output terminal and COM terminal, and so adjust potentiometer R180 that the negative output voltage becomes 37.0 V.

## 6.7 Adjustment of Dual Tracking

Set the positive output voltage at 35.0 V and the OUTPUT (-) knob at 0%, connect to the negative output terminals a voltmeter of an accuracy of 0.5% or better, and so adjust potentiometer R199 that the negative output voltage becomes 35.0 V.

## 6.8 Adjustment of Maximum Positive and Negative Currents

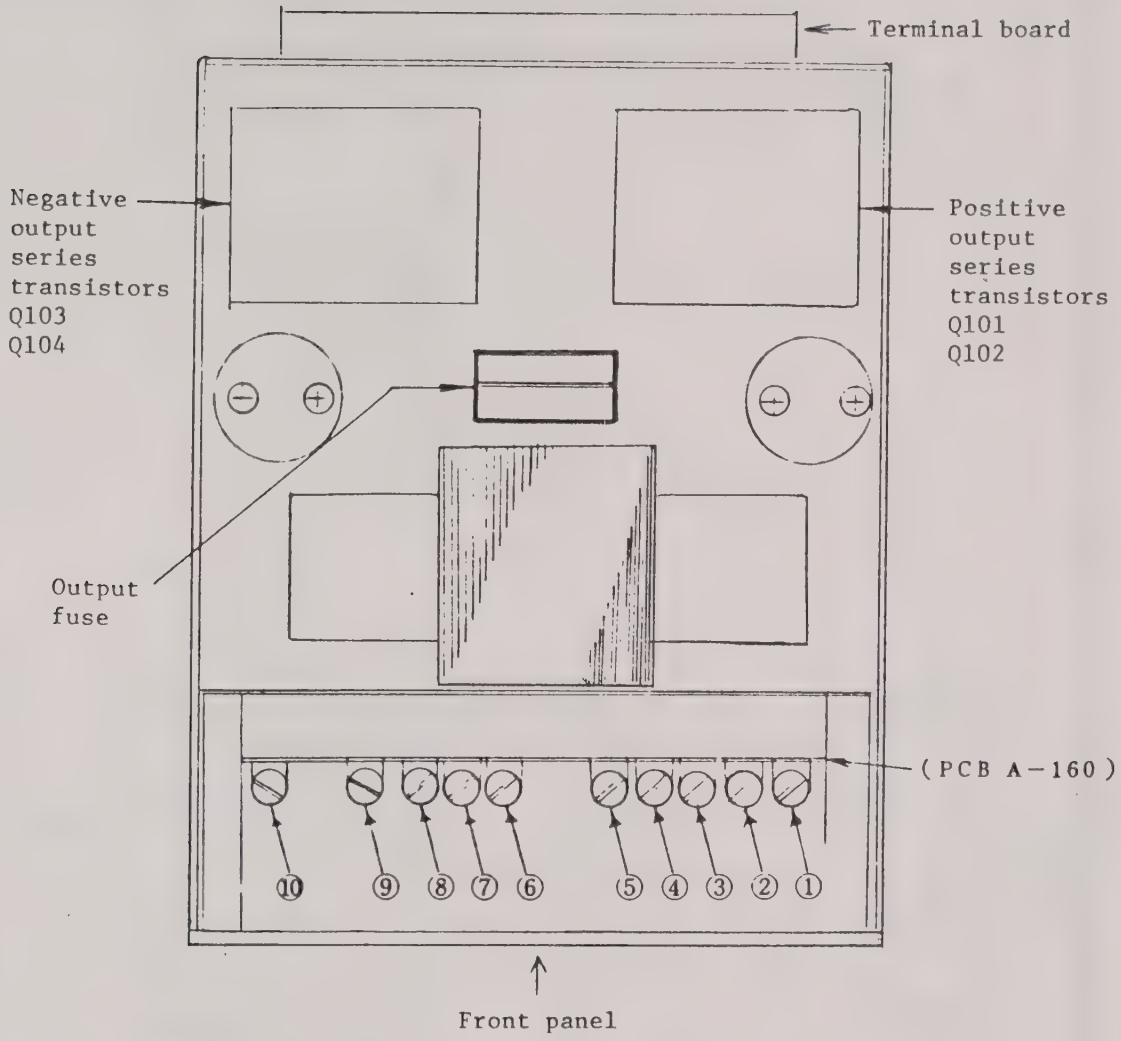
Connect to the positive output terminal an ammeter of an accuracy of 0.5% or better and so adjust potentiometer R163 that the current becomes 3.2 A. Connect to the negative output terminals an ammeter of an accuracy of 0.5% or better and so adjust potentiometer R164 that the current becomes 3.2 A.

## 6.9 Adjustment of Series Transistor Voltage ($V_{CE}$) of Positive Output

Connect an ammeter of an accuracy of 0.5% or better between collector and emitter of the series transistor mounted on the heat sink of the positive output circuit and so adjust potentiometer R127 that the voltmeter reads 7.0 V. (Conditions: Output voltage 35 V, output current 3 A, input voltage 100 V AC).

## 6.10 Adjustment of Series Transistor Voltage ($V_{CE}$) of Negative Output

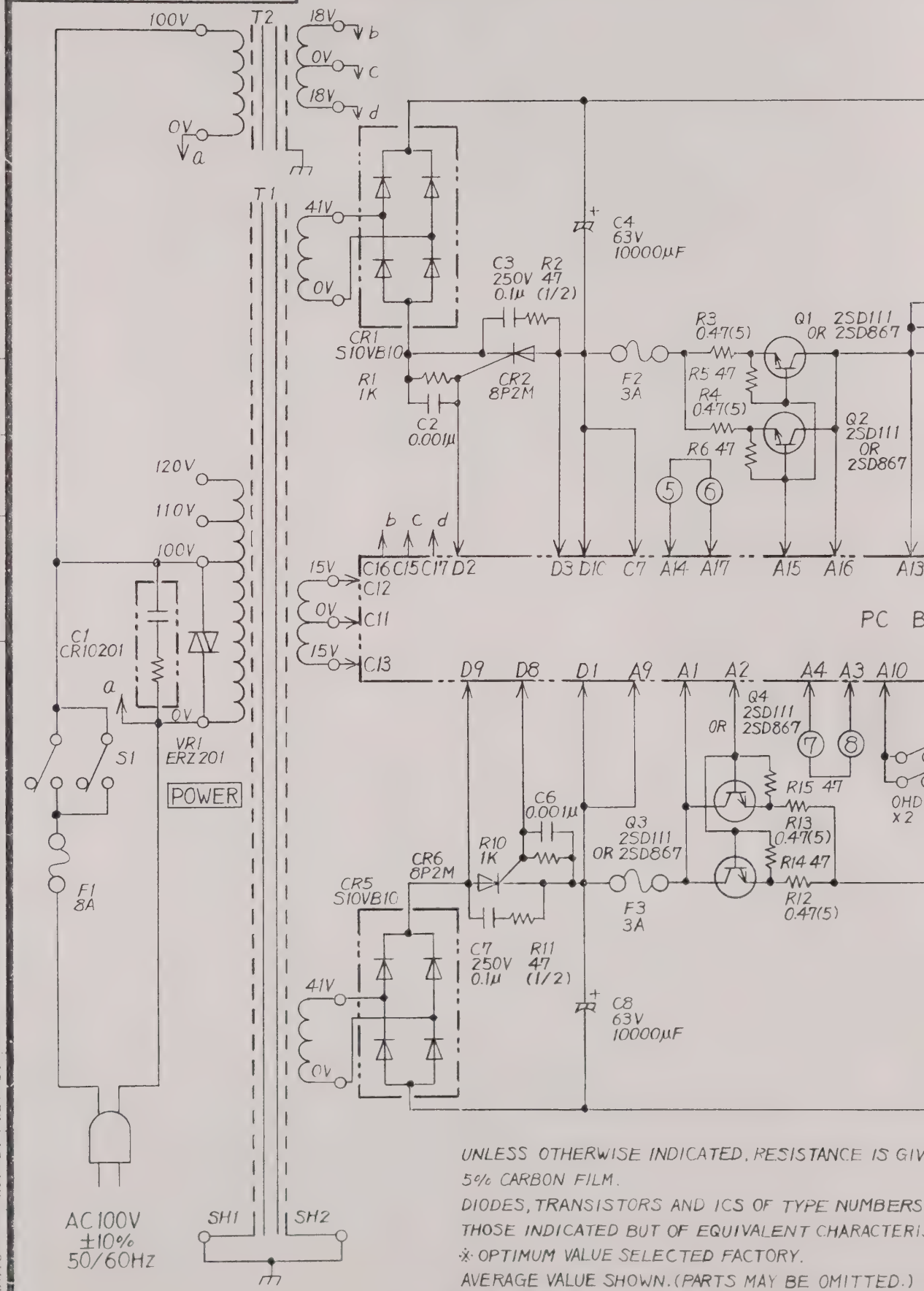
Connect an ammeter of an accuracy of 0.5% or better between collector and emitter of the series transistor mounted on the heat sink of the negative output circuit and so adjust potentiometer R166 that the voltmeter reads 7.0 V. (Conditions: Output voltage 35 V, output current 3 A, input voltage 100 V AC)


Terminal board
Negative output series transistors Q103 Q104
Positive output series transistors Q101 Q102
Output fuse
(PCB A-160)
⑩ ⑨ ⑧ ⑦ ⑥ ⑤ ④ ③ ② ①
Front panel

(1) R199: Adjustment of variable range of negative output
(2) R202: Adjustment of maximum positive output voltage
(3) R164: Adjustment of maximum negative output voltage
(4) R163: Adjustment of maximum positive output current
(5) R180: Adjustment of maximum negative output voltage
(6) R142: Adjustment of negative output ammeter
(7) R140: Adjustment of positive output ammeter
(3) R144: Adjustment of positive and negative voltmeter
(9) R116: Adjustment of negative output voltage $V_{CE}$
(10) R127: Adjustment of positive output voltage $V_{CE}$

Figure 6-1

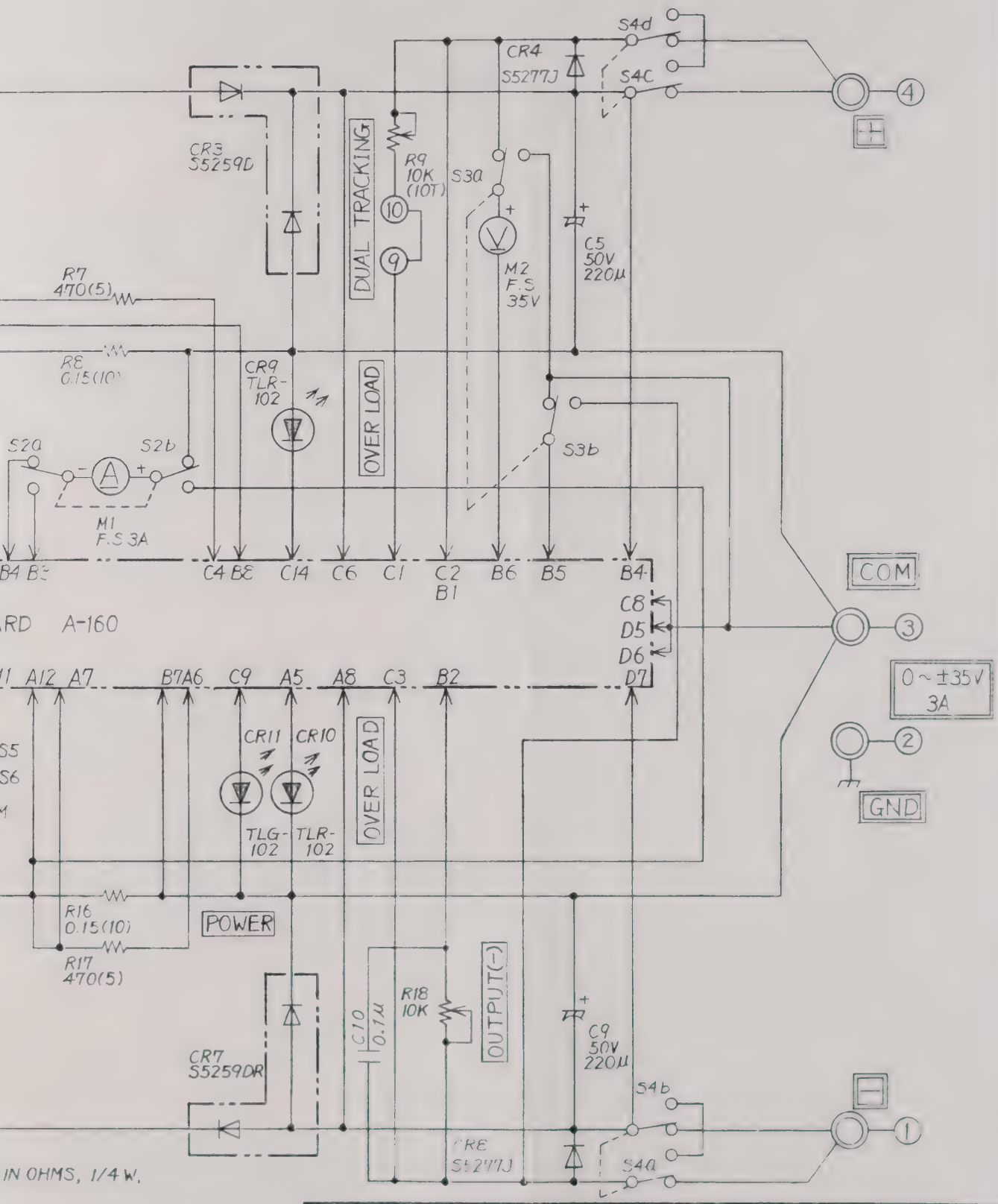
DRAWING NO. 3118668




UNLESS OTHERWISE INDICATED, RESISTANCE IS GIV
5% CARBON FILM.
DIODES, TRANSISTORS AND ICS OF TYPE NUMBERS
THOSE INDICATED BUT OF EQUIVALENT CHARACTERI
※ OPTIMUM VALUE SELECTED FACTORY.
AVERAGE VALUE SHOWN. (PARTS MAY BE OMITTED.)
△ METAL FILM RESISTOR.

CONTENTS | DATE | APP. BY | REV. BY

△6 '86.9.20 C10 0.1μ 追加
△5 '85.9.12 [illegible]




IN OHMS, 1/4 W.

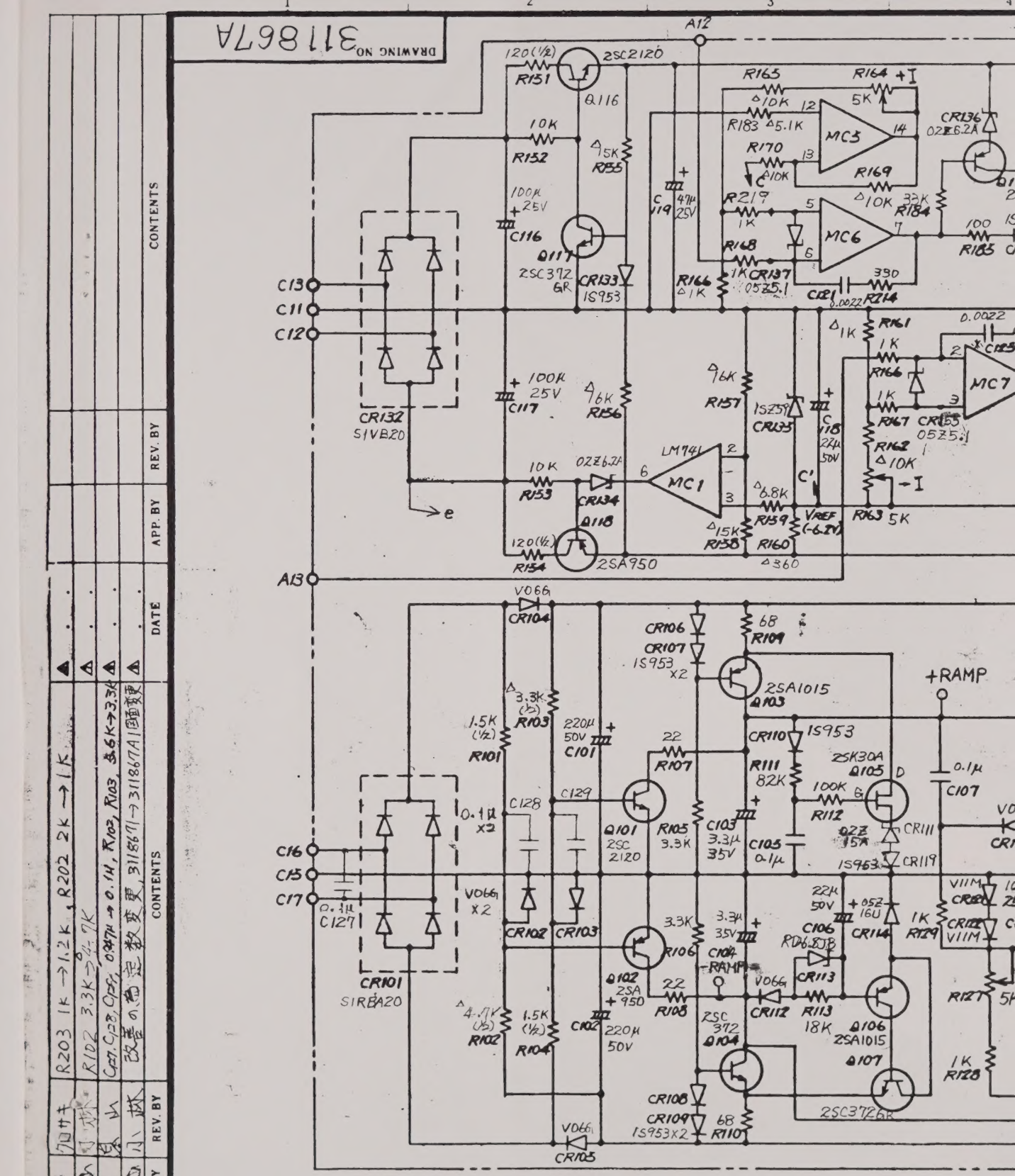
FFERENT FROM
CS MAY BE USED.

KIKUSUI ELECTRONICS CORPORATION

TITLE
PDM 35-3
CIRCUIT DIAGRAM

CODE No.

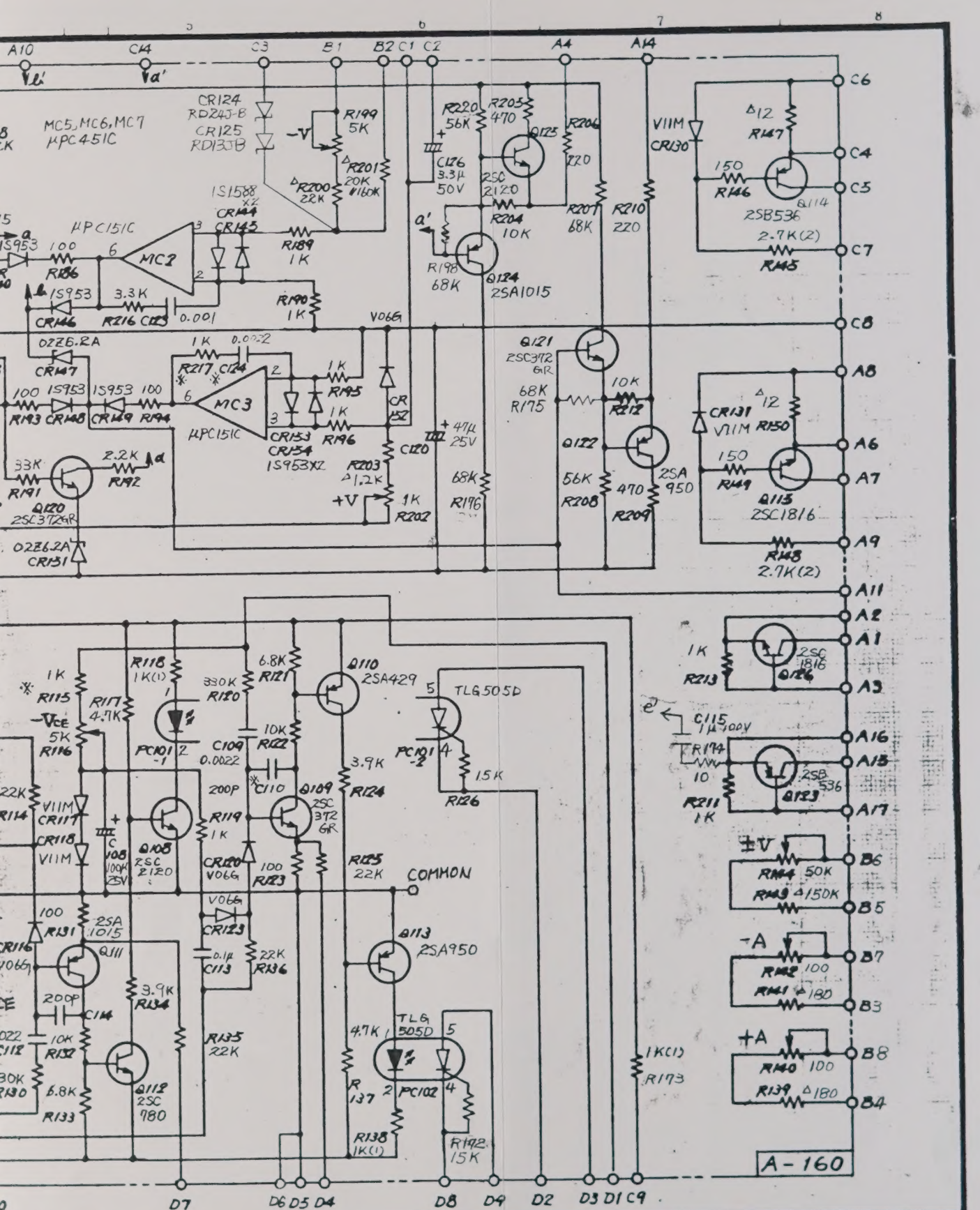
DRAWING No.




| DATE | APP. BY | REV. BY | CONTENTS |
|---|---|---|---|
| Δ '89.3.16 | 山井 | 加サキ | R203 1K → 1.2K, R202 2K → 1K |
| Δ '92.9.16 | [illegible] | [illegible] | R102 3.3K → 4.7K |
| Δ '80.7.4 | 山井 | 良山 | C27, C28, C95, 0.047μ → 0.1μ, R102, R103, 3.6K → 3.3K |
| '80.1.22 | 山井 | 小林 | 改善の為定数変更, 3118671 → 3118671A 回路変更 |

VO66 → VO66 or S5277J
1S953 → 1S953 or 1S1855

ALL RESISTOR ARE 1/4W 5% UNLESS
Δ: METAL FILM RESISTOR


A10
C4
C3
B1
B2
C1
C2
A4
A14
C6
C4
C5
C7
C8
A8
A6
A7
A9
A11
A12
A1
A3
A16
A15
A17
B6
B5
B7
B3
B8
B4
D7
D6
D5
D4
D8
D9
D2
D3
D1
C9
MC5, MC6, MC7
μPC451C
CR124
RD24J-B
CR125
RD13JB
-V
R199
5K
R201
20K
1160K
R200
22K
IS1588
X2
CR144
CR145
μPC151C
MC2
R189
1K
R190
1K
IS953
100
R186
3.3K
R216
C125
0.001
CR146
VOGG
0ZE6.2A
CR147
1K
0.0022
R217
C124
MC3
μPC151C
IS953
R193
CR148
CR149
R194
CR153
CR154
IS953X2
R195
1K
R196
CR152
C120
+47μ
25V
33K
R191
2.2K
R192
Q120
2SC3772GR
R203
1.2K
+V
1K
R202
68K
R196
0ZE6.2A
CR151
R220
56K
R205
470
Q125
C126
3.3μ
50V
250
2120
R204
10K
R206
220
R207
68K
R210
220
a'
R198
68K
Q124
2SA1015
VIIM
CR130
Δ12
R147
150
R146
Q114
2SB536
2.7K(2)
R145
Q121
2SC3772
GR
68K
R175
10K
R212
Q122
56K
R208
470
R209
2SA
950
CR131
VIIM
Δ12
R150
150
R149
Q115
2SC1816
R148
2.7K(2)
1K
R213
2SC
1816
Q116
C115
1μ 100V
R174
10
R211
1K
2SB
536
Q123
±V
R144
50K
R143
Δ150K
-A
R142
100
R141
Δ180
+A
R140
100
R139
Δ180
1K(1)
R173
1K
R115
-Vcc
5K
R116
R117
4.7K
R118
1K(1)
330K
R120
6.8K
R121
Q110
2SA429
TLG505D
PC101
-1
PC101
-2
C109
0.0022
10K
R122
C110
200P
Q109
2SC
3772
GR
3.9K
R124
15K
R126
R119
1K
Q108
2SC
2120
CR120
VOGG
100
R123
R125
22K
COMMON
VIIM
CR117
CR118
VIIM
C108
100K
25V
100
R131
2SA
1015
Q111
CR116
VOGG
CR123
VOGG
0.1μ
C113
22K
R136
Q113
2SA950
200P
C114
3.9K
R134
10K
R132
R135
22K
6.8K
R133
Q112
2SC
980
4.7K
TLG
505D
R137
PC102
R138
1K(1)
R142
15K
A-160
OTHERWISE INDICATED IN ( )
R220 C129
KIKUSUI ELECTRONICS CORPORATION
TITLE
PDM35-3 (A-160)
CIRCUIT DIAGRAM (3/3)
CODE NO.
DRAWING NO.
311867A

# LIMITED WARRANTY

All instruments sold by KIKUSUI INTERNATIONAL CORPORATION are warranted to the original purchaser against defects in materials and workmanship from the date of original shipment to the purchaser within the following time limits:

| | | |
|---|---|---|
| Oscilloscope | — | 2 year limited warranty |
| Power Supply | — | 5 year limited warranty |
| Test Instrument | — | 1 year limited warranty |

However, this warranty excludes accessories, batteries, lead wires, and probes. Also, this warranty does not apply to any instruments determined by KIKUSUI INTERNATIONAL CORPORATION to have been subjected to customer alteration, modification, negligence or misuse.

In the event of any defects determined by KIKUSUI INTERNATIONAL CORPORATION to be covered by this warranty, KIKUSUI INTERNATIONAL CORPORATION will, at its sole option, repair or replace the defective instrument without charge and at its expense reship anywhere in the United States. To obtain warranty service, the defective instrument must be returned within thirty (30) days after the expiration of the applicable warranty period to KIKUSUI INTERNATIONAL CORPORATION or an Authorized Warranty Repair Station, properly packaged and with transportation and insurance prepaid. This warranty is valid only in the United States of America. Any customers of KIKUSUI INTERNATIONAL CORPORATION located outside of the United States should check with their nearest Authorized Agent for warranty information applicable to them.

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